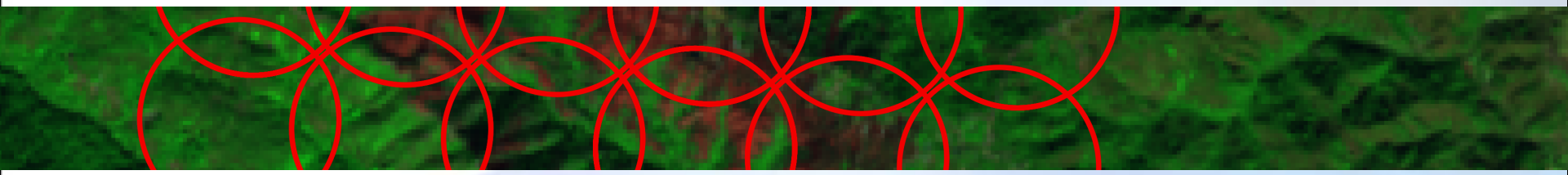
Utilization of Multi-Sensor Active Fire Detections to Map Fires in the US

- Project PI: Joshua Picotte (*Stephen Howard – retired*)
- Development Team: Michelle Anthony, Cheryl Holen, and Karthik Vanumamalai
- Partners: USDA Forest Service Forest of Florida, LANDFIRE, MTBS, St. John's Water Management District, and USGS EROS
- Project Summary:
  - Developed open source tools to incorporate Landsat imagery and fire detections to map fire perimeters and burn severity
  - Enables any user any where in the world to quickly assess fires in their area of interest
- Earth Observations applied: AVHRR, GOES, Landsat, MODIS, and VIIRS



Applied Sciences Program

Utilization of Multi-Sensor Active Fire Detections to Map Fires in the US

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Wildland Fire Program
ACTIVE PROJECT
February 28, 2017

Purpose and Objective

Our overall purpose is to utilize Landsat imagery to identify potential fire perimeters and active sensor data to help confirm these fire perimeters. Additionally we have developed an open source tool to download Landsat imagery, identify suitable imagers for fire mapping, and subsequently create an MTBS-like thresholded burn severity product.

Societal Benefit Area(s): Disasters and Ecological Forecasting
Geographic Focus: Worldwide
Targeted End-Users: Federal, State, University, and Non-profit land managers and researchers

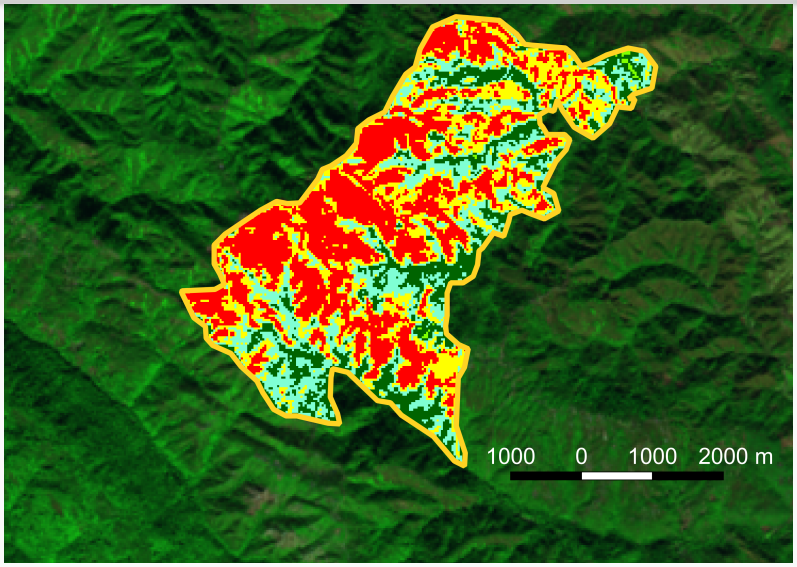


Figure 1: Example of a fire perimeter (yellow outline) and automatically derived burn severity breakpoints mapped using the QGIS open-source tool

Approach

1. Testing of tools by outside collaborators
2. Refine User Tools
3. Complete user guide
4. Deployment of fire detections (Web Feature Service [WFS] and Web Mapping Service [WMS])

Risks and Mitigation

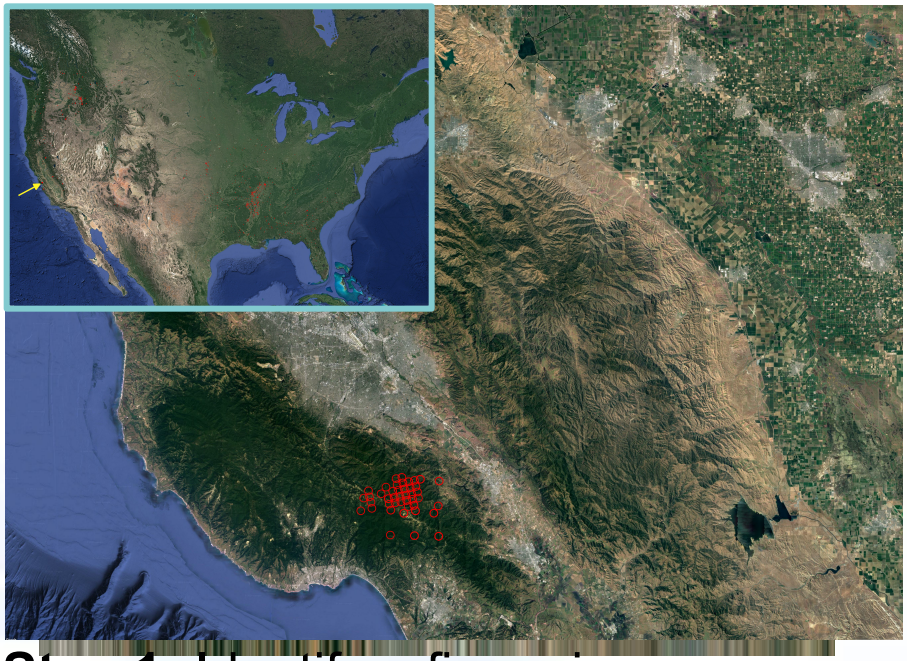
1. Changes in Landsat format/naming convention-Currently examining and will fix as necessary.
2. Worldwide Projections may take longer than expected-Currently implementing UTMs and will test as necessary.

Key Milestones

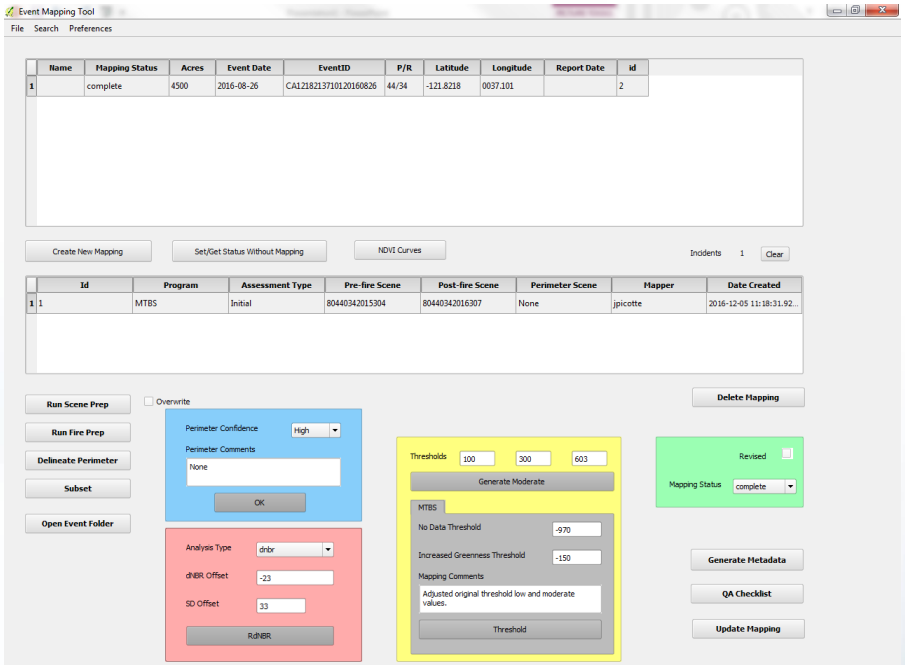
Milestone Statement	Date
Implementation of UTM projections	08/2017
Completion of QGIS Fire Mapping Tool	08/2017
Sensor Fire Detections (WMS and WFS)	08/2017
User Guide Completion	08/2017
Release of QGIS Tool	09/2017

$ARL_{Start} = 1$ $ARL_{Most\ Recent} = 6$ $ARL_{Goal} = 9$

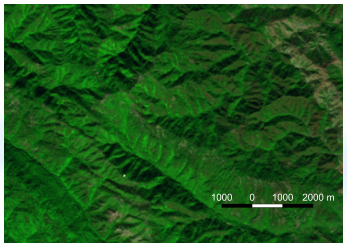
Biggest Achievement or Advancement to Date

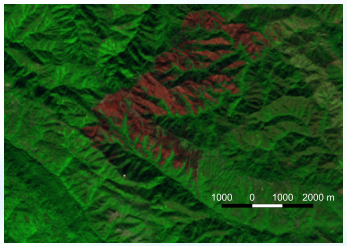


Step 1: Identify a fire using sensor detections or another data source

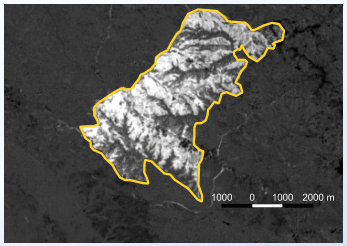


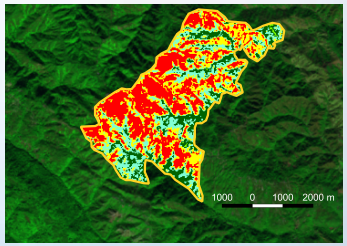
Step 2: Use QGIS tool to enter fire information and order imagery



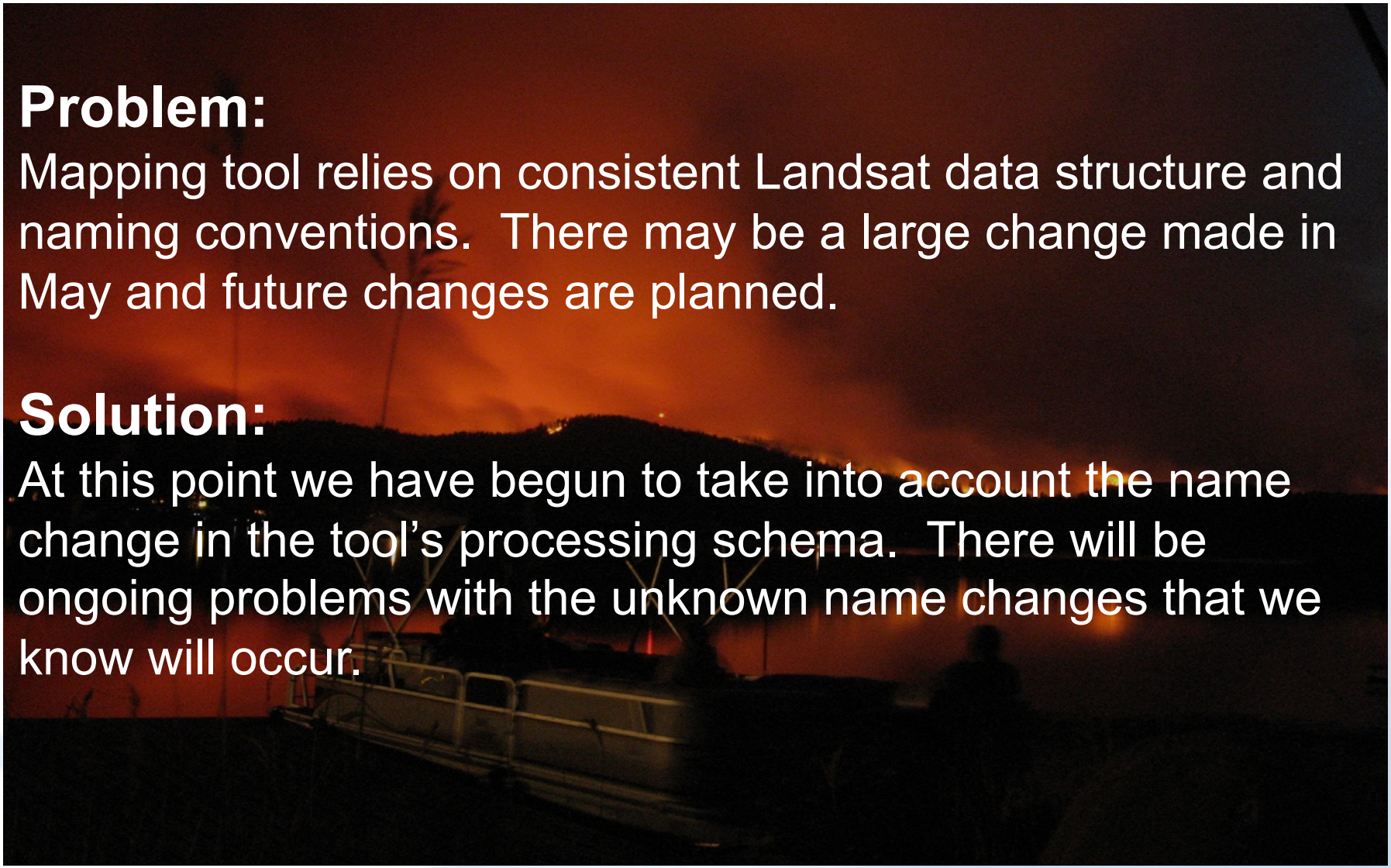


Step 3: Identify pre- (left) and post- (right) fire Landsat Scenes





Step 4: Map fire perimeter and burn severity



Problem:

Mapping tool relies on consistent Landsat data structure and naming conventions. There may be a large change made in May and future changes are planned.

Solution:

At this point we have begun to take into account the name change in the tool's processing schema. There will be ongoing problems with the unknown name changes that we know will occur.

PI Overall Assessment: Current Status

Summary of Challenges; Problems; Objective Analysis

- Tool distribution
- Tool does not yet handle worldwide projections
- Future changes to Landsat imagery
- Changes to distribution of sensor data

Signs of Positive Progress

- Tool can process current Landsat imagery
- All steps to the fire mapping process have been completed
- All historic sensor fire detections have been processed and will soon be served through a Web Feature Service (WFS) and Web Mapping Service (WMS)
- Beginning steps in dealing with worldwide projections has started

PI Assessment: Transition Plan (1 of 4)

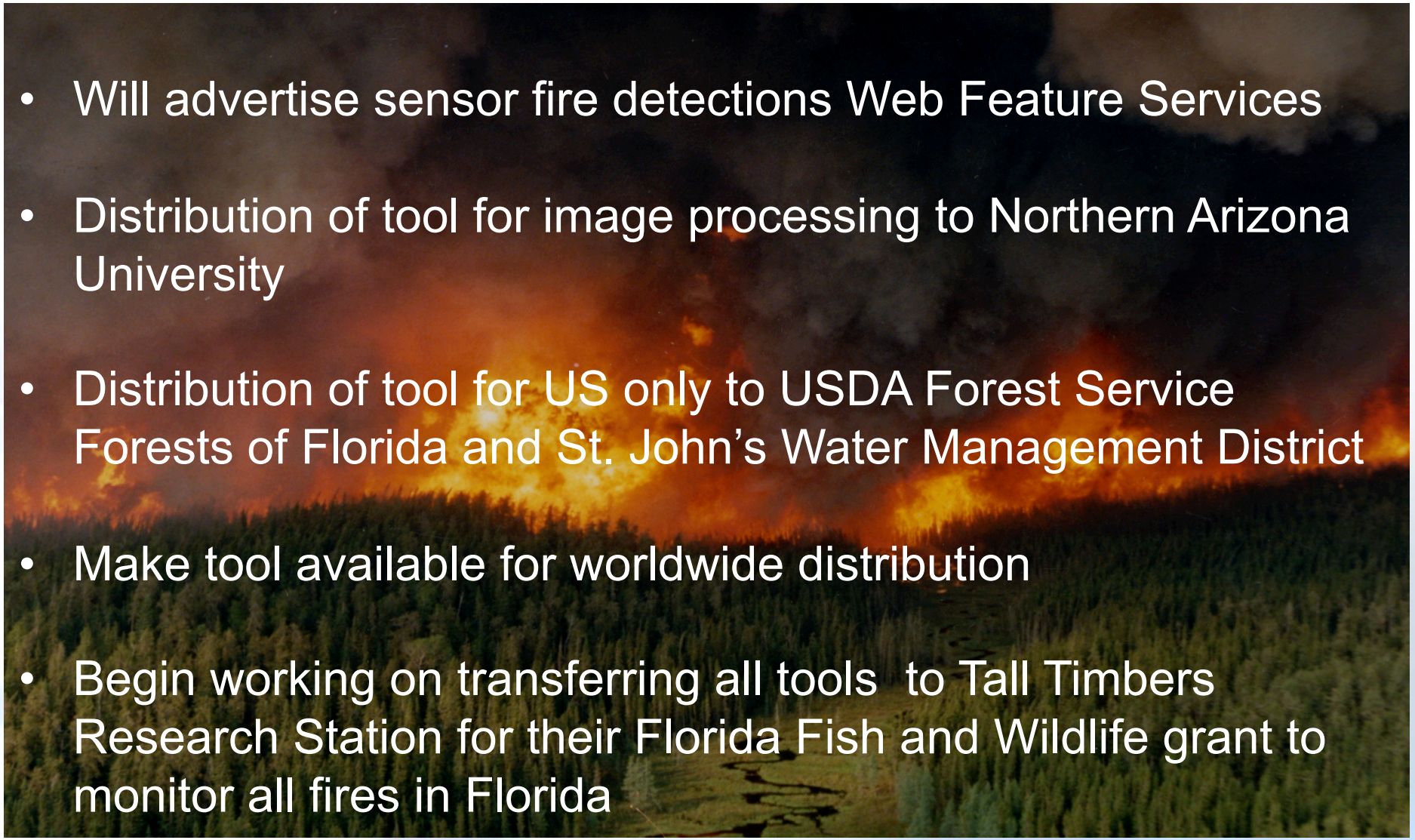
Project End Goals

- Testing of tools by collaborators
- Fix any potential problems
- Worldwide distribution

Remaining Steps

- Enable UTM worldwide projections
- Enable tool to work with changes in Landsat naming convention
- Sensor detections Web Feature Services deployment
- Completion of documentation

PI Assessment: Transition Plan (2 of 4)



- Will advertise sensor fire detections Web Feature Services
- Distribution of tool for image processing to Northern Arizona University
- Distribution of tool for US only to USDA Forest Service Forests of Florida and St. John's Water Management District
- Make tool available for worldwide distribution
- Begin working on transferring all tools to Tall Timbers Research Station for their Florida Fish and Wildlife grant to monitor all fires in Florida

PI Assessment: Transition Plan (3 of 4)

PI Overall Assessment: Transition (4 of 4)

- Enable download of reformatted Landsat data (April 2017)
- Enable QGIS tool to work with UTMs (August 2017)
- Completion of tool documentation (August 2017)
- Completion of tool after feedback from collaborators (September 2017)

One-stop tool distribution website

Completion Date: September 2017

Budget progress and future plans to spend down the funding by year.

$ARL_{Start} = 1$ $ARL_{Most\ Recent} = 6$ $ARL_{Goal} = 9$

PI Overall Assessment: Impact

Honest Opinion

Provides a much needed tool to allow worldwide users to track and map fires

Project's Impact/Potential as an Analogy

A rain drop striking a pool of water and causing outward waves

This small effort (rain drop) has the potential to result in many more fires being mapped (outward waves)

Relevant Publications, Awards, Accomplishments

- Completion of first version of open-source QGIS tool

- Picotte, J.J. and Howard, S.M. 2016, Development of open-source tools to map fire perimeters and burn severity utilizing Landsat and a suite of satellite detections [abs.], presentation at Fall Meeting, San Francisco, Calif., 12–16 December 2016, Fall Meeting Abstracts: Washington, D.C., American Geophysical Union

- Collaboration with Tall Timbers Research Station (Tallahassee, FL)